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IMPROVED DIETS BENEFIT CHILDREN IN INSTITUTIONS

Dietary studies in this country show that often children's meals fail to provide fully the nutrients considered necessary for optimum nutrition. Some of the studies have been made in homes, schools, and clinics. Others have been conducted in institutions where numbers of children could be observed at one time. The studies as a whole show that children's diets tend to be low in milk, green and yellow vegetables, and foods rich in ascorbic acid. In a few cases diets fail of adequacy by wide margins and the children give obvious indications of being undernourished. In most cases, the margin is relatively narrow and the children appear correspondingly better nourished, even though they are in reality in a suboptimal state of nutrition.

Lord Boyd Orr has described optimum nutrition as that state of nutrition which is not "susceptible of improvement" by any change in diet. Improvement in children, according to Orr, may be judged by growth and other signs of physical development. This concept of nutritional status is put to the test in the dietary studies described in this issue of NCN.

The studies—all conducted in institutions for children in this country—give evidence that even reasonably well fed children may fail to achieve optimum nutrition and that physical benefits to the children can be clearly demonstrated when suitable foods are added to their routine diets. The studies also emphasize that institutions need professional help in discovering their dietary shortcomings and selecting the additional foods needed to make their meals fully adequate. This need suggests an area in which nutritionists and nutrition committees can serve in the interest of better nourished children.

About The Studies In This Issue

The studies were carried on for most of a year or longer on groups of children. In each study the physical progress of children living on the regular institution diet is compared with that of children having certain foods added to that diet.

For the most part the children in the studies were in

"fair to good" nutriture on the regular institution diets and few if any would be classed as nutritional failures in the usual sense. Despite this fact they made noticeable gains by various criteria after food supplementation, even though the additions in most cases failed to bring the diet to full adequacy. Benefits varied with type of supplement but in general progress was expressed in terms of better growth rates, more favorable biochemical values as shown by tests of blood and urine, and improved skeletal and dental status.

ADDITIONAL MILK

Better Growth

Improvement in the growth of children in one institution was shown by Roberts (13)¹ by adding another pint of milk daily to the usual meals for each child. The rather meager original diet provided only 1 pint of milk

¹ Italic numbers in parentheses refer to Literature Cited, p. 4.

THIS NCN ISSUE AND ITS AUTHOR

This issue of NCN was prepared by Ethel Austin Martin, well known nutrition educator and author² with experience in universities and the food industry. Mrs. Martin is now serving on the Food and Nutrition Research Advisory Committee of the United States Department of Agriculture.

In this issue, Mrs. Martin considers the effect on the growth and development of children in institutions of adding to their often scanty diets small quantities of foods high in needed nutrients.

Nutrition committees could render a good service to an increasing child population by promoting and where feasible assisting in such studies and in the use of the findings. Such studies have implications for parents as well as food managers in children's institutions.

² Most recent publication: Robert's Nutrition Work with Children. Martin E. A. Univ. Chicago Press. 527 pp. 1954.

daily. Even with added milk the diet was considered below optimum in other respects. Throughout a year 1 group of 36 children remained on the usual diet as the controls. A second group, of the same number, received daily additional plain evaporated milk equivalent to a pint of fluid milk, and a third group, an equal amount of vitamin D evaporated milk.

Growth of the children given extra milk exceeded that of the controls, and there was little difference in results with the two types of milk. When comparison was made of gains in weight of individual children in 24 matched trios, gains of the child given plain milk were best in 46 percent of the trios, of the child given vitamin D milk in 42 percent, and of the control child in only 12 percent. Gains in height were of the same order but differences were less marked.

Earlier Skeletal Maturity

Better growth was not the only improvement observed. MacNair (8) found that the children receiving extra milk showed earlier skeletal maturity than those without it. She took X-rays of the wrists and hands of 108 of the children in Robert's milk study at the beginning and end of a year. Progress was indicated by changes in osseous development as shown by the Carter Ossification ratio (8). In 24 matched trios the child given plain milk progressed most rapidly in 44 percent of the comparisons, the child given vitamin D milk in 35 percent, and the control child in only 21 percent.

In a second MacNair study (7) cod liver oil was the supplement and results were of the same order.

ADDITIONAL FRUIT

Fruits, particularly those rich in ascorbic acid, are often scant in institutional meals. Hanke (5) experimented with adding about a pint of citrus juice daily to the diet of more than 300 children 10 to 17 years old. The usual diet was believed adequate except for ascorbic acid. Children receiving juice daily for a year were reported to have "a reduced rate of dental caries activity and gingival lesions and an increased rate of growth," over the previous year when the juice was not served. When vitamin C-rich foods are not practicable, an abundance of foods which are only a fair source of this vitamin can often make the diet adequate in ascorbic acid.

Roberts (12, 14) demonstrated this fact, using bananas as a supplement to a diet borderline in calories and ascorbic acid but otherwise adequate. The study included 100 boys 8 to 16 years of age in an institution. Each boy in an

experimental group received 2 to 3 bananas daily in addition to the regular diet. A medium-sized banana supplies about 90 calories and 10 mg. of ascorbic acid.

The mean plasma ascorbic acid values for experimental boys was 0.89 mg., for the others, 0.69 mg.—a significant difference. The authors say that "the bananas . . . provided a definite factor of safety in a diet otherwise questionable in its vitamin C content."

The boys receiving bananas made a slightly greater mean gain in weight and height than the controls; a larger percentage of them equaled or exceeded the gains "expected" during the period; and their mean percentage gain during the year was significantly greater. Boys receiving bananas also showed a slightly higher rate of ossification of the bones of the wrist than others.

ADDING MORE THAN ONE FOOD

It is seldom that any one food can fully supplement a deficient diet. Study may reveal that several nutrients are low and are best provided by increasing the amounts of more than one food. This was the case in each of the following studies in which children in institutions grew better and showed other signs of better physical progress when several foods were added to their inadequate meals.

Improved Growth

Blair (1) found better growth in 150 children, 2 to 14 years of age, when their diet was made liberally adequate for a year. The original diet failed to meet the National Research Council's Recommended Dietary Allowances (1943) in all nutrient factors except vitamin A; most marked deficiencies were in thiamine and ascorbic acid. The foods increased were milk and its products, eggs, whole-grain cereals, and fruit juice. The supplemented diet achieved the goal of the investigators to provide the kinds and amounts of foods advised in a commonly accepted dietary pattern for children and to meet the dietary allowances for the children.

The children served as their own controls and growth progress was noted before, during, and after supplementation. In the preperiod, the group as a whole averaged only 61 percent of its expected gain in weight. In the supplementation period, the percentage rose to 140 percent and gains continued at a high level in the after period. Gains in height followed a similar pattern.

Mack (10) made similar observations for a year on 234 boys, 7 to 15 years of age, living on a diet considered nutritionally adequate except for ascorbic acid. During the next 2 years, the diet included more citrus fruits,

tomatoes, potatoes, sugar, and meat including organ meats. Other vegetables and fruits, eggs, and cereals remained at about the same level. Consumption of legumes dropped sharply. Milk intake, on an ad lib. basis, decreased slightly but still averaged about 1 quart per boy a day.

Despite the increase in calories, Mack's boys did not gain weight unduly on the new diet. In fact the number in the original group designated as "obese," according to the Wetzel Grid, decreased. The few who seemed underweight before the change, tended to gain more satisfactorily. The percentage of children in the "good" classification increased somewhat.

On the more ample diet the boys also progressed consistently in the skeletal maturation. The figure rose from 62 to 74 percent in the highest class of skeletal maturity (no more than 6 months retarded in comparison with Western Reserve standards for bone development (4)) at the end of 2 years.

Higher Biochemical Values

Oldham (11) tested the children studied by Blair (1) to see if an improved diet would register in terms of improved blood and urine values. Blood levels of vitamin A, carotene, hemoglobin, and thiamine were determined, serum protein and plasma ascorbic acid values were obtained, and fasting 1-hour excretions and 4-hour returns of thiamine and riboflavin test doses were studied. All determinations were made at the beginning of the year, when the children were receiving only the original institutional diet, and were repeated several months later, after intakes of all nutrients had been brought up to recommended dietary allowances.

In general, biochemical values increased with the improved diet. Most clear-cut was the rise in plasma ascorbic acid and blood thiamine levels which in many children were very low at the first of the year—those same nutrients in which the original diet was most markedly deficient.

In the Mack study (10) several biochemical tests were made. As might be expected, on the unsupplemented diet which was essentially adequate, test values fell within or approached the normal range for children with the exception of plasma ascorbic acid which was considered low by some standards. On the supplemented diet, values were higher for almost all biochemical tests.

Improved Dental Status

Arrest of dental caries has also been used as a measure of improved nutritional status. McBeath (6), Mack (10), Boyd (2), Drain (3), and others, working in institutions have shown that diets nutritionally adequate for children tend to deter development of dental caries. This holds true

despite the widely varying character of the studies. Some findings are less conclusive than others. Differences in the caries susceptibility of teeth alone would appear to be sufficient cause for variation in results.

McBeath (6) observed a definite reduction in dental caries rate in an experimental group of children in each of three institutions when their original diets were augmented for a year with milk, eggs, meat, vegetables, and cod liver oil. During a second year when he reversed experimental and control groups, he witnessed an increase in caries in the new group on the routine diet and a decrease in rate in the new group on the augmented diet.

In Mack's study (10), the boys showed a much smaller rate of increase in dental lesions than the average rate for groups of comparable age composition in her Pennsylvania nutrition studies (9). The fact that the higher sugar content of the more ample diet did not cause a marked increase in dental caries activity the authors attributed to the generally superior diet, excellent dental care, giving the sweets at mealtime, and encouraging the brushing of teeth soon thereafter.

For 2 years Boyd (2) observed caries development in an institution for feeble-minded children. Then for a year 64 adolescent girls from the group received a diet reported to be nutritionally liberal; details of its content are not given. During the first 6 months all refined sugar and its products were excluded. During the second 6 months 3 ounces or more of sucrose was added daily, usually in prepared foods, sometimes as candy to be eaten with meals.

Boyd was unable to demonstrate significant differences in the advance of caries among these children, either as between experimental and control groups or as between the two types of diet. It seems possible that the dietary periods were too short to show differences. Boyd points out, as did Mack, that the sweets were given under prescribed circumstances and as part of an abundant and nutritionally adequate food intake—conditions which would make it dangerous to apply the findings generally to child feeding.

Drain and Boyd's study (3) in a home for children tend to verify their findings on clinic and hospitalized subjects, that an adequate diet reduces caries activity. They observed 53 children, averaging 7 years in age, for 8 months. During that time the regular diet was fortified with "ample milk, butter, and eggs." Arrest of caries activity was observed in 42 of the 53 children by the end of the 8 months.

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IN CONCLUSION

Evidence that the nutriture of children in institutions is often "susceptible of improvement," gathers force when data from these studies are examined. In the main, the children who grew better on the supplemented diets were the same ones who showed more favorable blood and urine values and who also progressed more rapidly toward skeletal maturity than the control children on the unsupplemented diets.

The findings emphasize the well-known fact that sub-optimal nutrition in mild degree, rather than gross under-nutrition of children, is the problem in this country. Nutritionists need to be increasingly alert to the small but real differences a change from a near-adequate to an adequate diet can make in the nutritional well-being of children.

These findings of nutritional studies on children appear to justify the following conclusions:

1. Children's diets in institutions frequently fall short of full dietary adequacy.
2. A survey to discover which nutrients may be low in children's meals will indicate the foods which need to be added.
3. Adjustments in children's diets, to make them fully adequate, can often be made by adding relatively small amounts of foods which provide needed nutrients, with little additional cost or change in character and acceptability of meals.
4. Children on near-adequate diets and in a "fair" state of nutriture may make measurable progress toward optimum nutrition when suitable foods are added to their daily meals.
5. The findings of institutional studies have wide application to child feeding, as borne out by confirmatory data from studies of supplemented home diets, both here and abroad.

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